ANC08FA053
Changes to Factual Report
July 7, 2015

FACTUAL NARRATIVE

HISTORY OF FLIGHT

On April 15, 2008, about 0923 Alaska daylight time, a Eurocopter AS-350-B2 helicopter, N213EH, sustained substantial damage during an emergency descent and impact with terrain, about 34 miles east of Chickaloon, Alaska. The helicopter was being operated as a visual flight rules (VFR) cross-country passenger flight under Title 14, CFR Part 135, when the accident occurred. The helicopter was owned and operated by ERA Helicopters, LLC., Anchorage, Alaska. The commercial pilot and three passengers were killed, and one passenger, the 15-year-old stepson of one of the deceased passengers, sustained serious injuries. Visual meteorological conditions were reported in the area at the time of the accident, and company flight following procedures were in effect. The flight originated at the operator's base in Anchorage about 0742, en route to various communication sites near Chickaloon.

During a telephone conversation with the National Transportation Safety Board (NTSB) investigator-in-charge (IIC) on April 17, the operator's general manager reported that the purpose of the flight was to shuttle State of Alaska telecommunications technicians and equipment between three remote communication sites near Chickaloon. He noted the helicopter departed the Anchorage base with only the pilot aboard. The manager said that the pilot was instructed to land at the State of Alaska's telecommunication heliport in Anchorage to pick up three technicians and their equipment, and then fly to the communication sites near Chickaloon.

During a telephone conversation with the NTSB IIC on April 17, a technician that was aboard the helicopter when it departed from the Anchorage telecommunications facility reported that after departure the crew planned to meet an additional technician at the first of three communication sites to drop off equipment. He said as they approached the first site they realized that the technician they planned to meet was not there, so they continued to the second site. The technician said the helicopter landed at the second site about 0900, and left him there. It was agreed that the helicopter would return by 1300 to pick him up. The technician reported that after the helicopter departed from the second site, and before continuing on to the third site to drop off the two remaining technicians and their equipment, the pilot was to fly to a rest area along the highway, and pick up one other technician that would be waiting with additional equipment to be transported to the third communication site. The technician said he was unaware that the other technician would have his stepson with him.

When the flight failed to return by 1300, the technician contacted the State of Alaska's telecommunications shop, but was told that the other technicians had a lot of work to do, and to

give them more time. When the flight still had not returned by 1400, the technician again contacted the State of Alaska's telecommunications shop. As a result, the State notified the operator, who attempted unsuccessfully to contact the helicopter via satellite telephone and aircraft radio. The operator reported the helicopter overdue to the Federal Aviation Administration (FAA) at 1540, and they contacted the Air Force Rescue Coordination Center.

The Air Force Rescue Coordination Center (AFRCC) at Elmendorf Air Force Base, Anchorage, had received the first alert of a signal from a 121.5 MHZ emergency locator transmitter (ELT) signal at 1121 that day. They were unaware at the time that the accident helicopter had crashed, but were already in the process of organizing a search related to the unknown source of the ELT signal.

Personnel of the Alaska State Troopers, Civil Air Patrol, Alaska Mountain Search and Rescue, and the Alaska Air National Guard, were dispatched to search for the helicopter, but blizzard weather conditions limited search personnel to a ground search until weather conditions improved the next day.

The helicopter's wreckage was located on April 16, about 0750, in an area of hilly, tree-covered terrain, about three-quarters of a mile from the highway rest area where the technician and his stepson were picked up. Additional details of the search and rescue follow in the Search and Rescue section of this report.

During an interview with the NTSB IIC on May 27, the sole survivor of the accident, a 15-year-old juvenile, reported that he was asked to accompany his stepfather, who was a telecommunications technician with the State of Alaska, to the third communication site. The boy said that after the helicopter landed in the parking area of the highway rest stop, the pilot shutdown the helicopter before additional equipment was loaded. He said that before departing from the parking lot, he was placed in the front left seat, and the other three passengers were seated in the aft seats. The juvenile noted that he took with him a small day-pack, which contained a bag lunch and two bottles of water. He did not recall where he placed the day-pack.

Due to injuries sustained in the accident, the juvenile said he was unable to recall many details of the accident.

According to management personnel with ERA Helicopters, and management personnel with the State of Alaska's Telecommunications Division, neither knew that the juvenile was on board the accident helicopter.

On the morning of the accident, a motorist about one mile south, traveling northbound on the highway saw the helicopter lift off from the roadside, and fly in an east south-east direction. The motorist estimated the visibility to be about 2 miles in light snow. He said he saw the helicopter flying below the overcast, and it made a steep descending right turn toward the ground. He said initially he thought the helicopter was going to crash, but as he approached the

area where the helicopter departed, he saw the ravine where the helicopter made the descent. The motorist was familiar with helicopter operations from his job working on the Alaska pipeline, and thought the helicopter was probably working in the ravine. He said it was not unusual to see helicopters working along the highway, but he thought the steep descent was unusual, and commented to a friend after arriving at his work site, about the helicopter and the scary ride the pilot must have given the passengers. He said he did not hear about the accident until several days later, and then contacted the IIC.

INJURY TO PERSONS

The pilot and four passengers were aboard the helicopter at the time of the accident. The helicopter wreckage was reached by rescuers about 24 hours after the accident. The pilot in the right front seat and the two passengers in the right rear and center rear seats were found dead in the helicopter. The third passenger in the left rear seat had exited the helicopter, and was found dead outside the helicopter. The fourth passenger, the juvenile, had been seated in the left front seat, and was found incoherent, wandering in a ravine at the base of the slope where the helicopter impacted. He was transported to a hospital in an Alaska State Trooper helicopter, and according to the transporting helicopter's observer/EMT, he had a head injury, and was suffering from hypothermia.

DAMAGE TO AIRCRAFT

The helicopter received substantial damage to the fuselage, tail boom, tail and main rotor systems, and the rotor drive train.

PERSONNEL INFORMATION

The pilot held a commercial helicopter certificate with a helicopter instrument rating. He also held a helicopter flight instructor certificate with an instrument helicopter rating. His most recent second-class medical certificate was issued on March 5, 2008, and contained no limitations.

According to the Pilot/Operator Aircraft Accident Report, (NTSB Form 6120.1) submitted by ERA Helicopters, the pilot's total aeronautical experience was about 3,747 flight hours, of which about 1,889 flight hours were in the accident helicopter make and model. In the preceding 90 and 30 days prior to the accident, the pilot flew a total of 47.3 and 9.6 flight hours.

The operator's pilot training records showed no deficiencies, and that the accident pilot had completed all required training, including a required CFR Part 135 proficiency check ride on June 11, 2007.

AIRCRAFT INFORMATION

The helicopter was a Eurocopter AS-350-B2, equipped with a Turbomeca Arriel 1D1 turboshaft engine.

The helicopter was maintained under the operator's Approved Aircraft Inspection Program (AAIP), which requires inspections to be performed approximately every 100 flight hours. The helicopter had 4,983.7 flight hours in service at the time of the accident 11 flight hours had elapsed since the most recent phase inspection. An examination of the helicopter's maintenance logs showed no mechanical discrepancies.

METEOROLOGICAL INFORMATION

The technician who was dropped off at the second communications site said the weather had been good along the route from their departure in Anchorage to the site where he left the helicopter, but by 1400 he said he could see bad weather rapidly approaching from the southwest. He said he knew that if they did not depart soon the approaching weather would preclude the use of the helicopter. The helicopter did not return, and the technician spent the night at the communication site due to the snowstorm that arrived shortly after 1400.

The closest weather reporting station was the automated weather station at Sheep Mountain Airport, 4.5 miles to the west of the accident site. The automated weather observation at 0850 ADT the morning of the accident recorded the wind from 250 degrees at 3 knots, visibility 2 statute miles, ceiling 400 feet overcast, altimeter 29.42 inches of mercury, temperature 27 degrees F, and dew point 23 degrees F.

The accident site was about three-quarters of a mile to the east of the Glenn Highway (Alaska Highway 1). The highway follows a river valley bounded on both sides by rising terrain. There is an FAA weather camera co-located with the State of Alaska communication tower at Tahneta Pass, the helicopter's destination, about 1.5 miles southeast of the accident site. There is an FAA automated weather station and camera at Sheep Mountain, about 5 miles north-northwest of the accident site. Weather station and camera data from both locations showed VFR conditions at the lower part of the helicopter's route, and marginal VFR conditions in the area of the accident. Visibility varied from 1-2 miles in light snow, and ceilings varied from 300-500 feet above the terrain with patches of blue sky visible. A detailed meteorological evaluation prepared by an NTSB meteorologist is in this report's public docket.

COMMUNICATIONS

There were no known communications with the helicopter after its departure from the State of Alaska's communication facility in Anchorage. The helicopter pilot had a satellite telephone available in the helicopter, and according to the operator, he routinely called in upon reaching his destination. The morning of the accident the pilot did not report arriving at the destination, but such routine reporting is not required by the operator's policy, and no action was taken.

The helicopter was equipped with a commercial satellite tracking system provided by Sky Connect, Takoma Park, Maryland, which allowed monitoring of the helicopter's movements by the operator. The position of the helicopter was displayed on a map representation on computer terminals at the operator's Anchorage facility, and according to the operator, information was updated in about one minute intervals. The geographic display was a small scale, large area map presentation with very little detail. A list of the helicopter's Global Positioning System (GPS) coordinates, airspeed, altitude, heading, and time were viewable on additional computer pages available at the operator's Lake Charles, Louisiana, facility, but not available at the Anchorage facility. The track data provided by the operator shows each leg of the day's flights starting with "power on", then "departure" (signaled by collective movement and/or airspeed indication), followed by "scheduled" (data transmissions from the helicopter), then "arrival" (signaled by collective down), and finishes with a "flight summary." The last entry for the accident helicopter, in the history information data provided from the Lake Charles facility showed, 04/15/08, 09:30.41, "OVERDUE," meaning that the helicopter's equipment stopped transmitting data prior to the arrival sequence. The "OVERDUE" information was not available to the operator in Anchorage.

According to the satellite data, the accident flight from departure at the roadside to the accident site lasted less than one minute. The operator's personnel at Lake Charles did not monitor Alaska flights, and no known "overdue" alarm was set. According to the operator in Anchorage, the position of the helicopter had been noted, but on the large area display the helicopter appeared to be near one of several destinations scheduled for that day. The operator made no attempt to contact the helicopter throughout the day, until the State reported to the operator that the helicopter had not returned to pickup the technician at the second communication site.

WRECKAGE AND IMPACT INFORMATION

On April 16, 2008, the NTSB IIC, along with an Alaska State Trooper, and an FAA airworthiness inspector from the Anchorage Flight Standards District Office (FSDO), traveled to the accident site via helicopter and examined the wreckage.

The third communication site, the helicopter's destination (elevation 3,681 feet), was 2.2 miles and across a ravine from the pickup/departure point (elevation 3,259 feet), a rest area along Alaska State Highway 1. On a clear day the destination communication site is visible from the highway. The accident site is about three-quarters of a mile from the departure point in the general direction of the destination, but south of a direct line to the destination.

All of the helicopter's major components were found at the main wreckage site.

The helicopter impacted on the steep west side embankment of a dry ravine, which leads generally southeast to a river. The helicopter was about 30 feet from the top of the ravine, and about 80 feet from the bottom. The embankment incline was approximately 35-50 degrees, and

was covered with willow brush, and about 3-5 feet of snow. Several inches of snow had fallen on the helicopter since the accident.

The helicopter came to rest on the embankment facing approximately southeast, parallel to the embankment. The impact crater and crush lines were consistent with a steep vertical descent. The fuselage was in a level attitude, and the right side pilot's door was displaced aft about 4 feet. The transmission was leaning to the right (into the bank), and all three main rotor blades had impact damage. On the AS-350-B2 helicopter the main rotor blades and their associated components are color coded red, blue, and yellow. The red main rotor blade was pointed forward in relation to the fuselage, and had leading edge damage. Its trailing edge was split open in numerous areas, and about 18 inches of the lower skin was torn near the tip. The tip was touching the ground in front of the helicopter, and the red blade had standing willow bushes on both sides. The blade remained attached to the Starflex rotor assembly.

The blue blade was pointed to the right of the fuselage and flexed upward into the ascending bank. The blade was punctured and torn vertically about mid-span, and came to rest in a willow bush, with unbroken branches on both sides of the blade. The blade remained attached to the Starflex rotor assembly, and the blue star arm was broken near the outboard frequency adapter.

The yellow blade was pointed to the left, and suspended over the ravine. The blade had leading edge damage, and a sharp downward bend about 3 feet from the grip. From the bend outward the trailing edge of the blade was splayed open. The blade remained attached to the Starflex rotor assembly; however the yellow star arm was fractured about mid-span with an angular fracture surface.

The majority of terrain intrusion from the impact into the fuselage was at the right-side aft cabin bulkhead. The pilot's door had been displaced aft about 4 feet, to the aft cabin bulkhead. The right passenger door was bent in half and pushed back to the aft cabin bulkhead. The tail boom was bent downward at the fuselage. Both tail rotor blades were broken near the hub. The left side of the helicopter had minor damage, and from the midline of the fuselage was suspended from the embankment into the air. The internal fuel tank was broken open, and there was a strong smell of turbine fuel. The floor mounted fuel flow control lever was found in the forward emergency position, and the adjacent emergency fuel shutoff lever was found in the aft (off) position.

Upon completion of the on-site examination, the IIC was flown to the roadside where the helicopter had picked up the technician and his stepson. The roadside is a large parking area on the north side of the highway. There were no obstructions in the parking area tall enough to interfere with the main rotor. The departure path toward the accident site was clear of obstructions, and the terrain in the direction of the accident site descends about 400 feet in three-quarters of a mile.

The helicopter was recovered to the operator's hangar in Anchorage on April 22.

The wreckage examination reconvened on April 24. The engine and transmission were externally examined, and removed for shipment to their respective manufacturer's facilities in Grand Prairie, Texas. The tailrotor and main rotor blades were examined along with the fuselage. The hydraulic flight control system was removed for further examination. The twisted engine to transmission main driveshaft, and cockpit area were also examined, and the engine's control lever positions were documented.

On May 20 and 21, the engine and transmission were examined at the Turbomeca and American Eurocopter facilities in Grand Prairie. The engine examination disclosed a 7 millimeter misalignment of the module 5 drive nut indicative of an overtorque event and ~~no preimpact mechanical anomalies other than~~ free turbine blade shedding indicative of an overspeed event. According to the engine manufacturer, free turbine blade shedding occurs by design when the engine exceeds 150% NF (free turbine RPM), or 62,374 RPM. The turbine blade shedding is a safety measure designed to keep the turbine wheel from becoming unbalanced and coming apart during an engine over speed. According to the engine manufacturer, the two most common events that result in an in-flight engine over speed are failure of the fuel governor, or failure of the fuel control diaphragm. Both are fuel control unit malfunctions. The fuel control unit was removed from the engine, and bench tested. During the tests the fuel control unit performed normally, within specified parameters.

Discussions with the helicopter and engine manufacturers' representatives during the examination disclosed a third event that could result in an engine overspeed: Decoupling of the engine from the transmission due to the over torque of the engine to main rotor gear box transmission shaft, resulting in the failure of the shaft or its couplings. According to the representatives, this type of over torque could result from a main rotor blade strike, malfunction of the freewheel assembly, or seizure of the main transmission. The examination revealed the engine to main rotor gear box drive shaft was twisted and shortened, liberating the splined (aft) end of the shaft (male) from the engine output spline (female). There was no obvious evidence of an in-flight, main rotor blade strike, and examinations of both the main transmission and freewheel assembly showed no pre-impact anomalies that would have precluded normal operation.

On June 4, 2008, the IIC, accompanied by another NTSB investigator, and an FAA air safety inspector, returned via helicopter to the rest area where the accident helicopter departed on the final leg of the accident flight. After examining the rest area the helicopter departed on the apparent route of the accident helicopter to the accident site. The IIC's group examined the route and area for signs of a main rotor blade strike, but found none.

According to the helicopter manufacturer, there are no engine control inputs by the pilot that could produce an over torque which could decouple the engine.

Examinations revealed that the helicopter's drive train had three complete breaks or separations. The main engine to transmission drive-shaft had twisted and shortened, liberating the splined (aft) end of the shaft from the engine output. The direction of driveshaft twist was consistent with an opposing torque load forward of the driveshaft. The splined (aft) end of the driveshaft and the forward splines of the engine power shaft (adjacent to the freewheel unit) exhibited evidence of rotational smearing at the aft and forward tips of the splines, respectively. The smeared material was biased in the direction of engine drive. The engine to short tail rotor drive-shaft coupling was torsionally separated. The flex coupling discs were splayed, scoring the inside of the driveshaft tunnel, and the tailrotor driveshaft key had sheared inside the tailrotor hub. ~~All three breaks or separations were consistent with sudden stoppage of the main and tailrotor blades during impact.~~

An examination of the freewheel unit was done on December 2, at Formsprag, the manufacturer's facility in Warren, Michigan, under the supervision of the NTSB. No preimpact anomalies were noted.

The hydraulic flight control system components were examined on April 21, 2009, at the Eurocopter facility, Fort Erie, Canada, under the supervision of the Canadian Transportation Safety Board, at the request of the NTSB IIC. All of the components operated within their specified limits.

The fuel flow lever, emergency fuel shutoff lever, and the rotor brake lever are floor mounted between the two front seats of the helicopter. During the on-site and subsequent cockpit examinations, the positions of the fuel flow control lever and the fuel shutoff lever were documented and photographed. The fuel flow control lever was found in the forward (emergency) position, and the external indicator located on the engine fuel control indicated the same. The emergency fuel shutoff lever has a copper safety wire securing it in the forward (on) position. The safety wire was broken, and the fuel shutoff lever was found in the full aft detent (off) position. During a third examination of the helicopter, the IIC confirmed that the levers were in the positions initially photographed at the accident site, and upon closer examination found that the linkages and cables that operate the fuel flow control lever, emergency fuel shutoff lever, and rotor brake lever were trapped in the wreckage at impact, and could not be moved from their previously recorded/photographed positions.

After the NTSB released the wreckage, further examination of the engine was performed in October 2012. The examination showed that the first and second stage compressor turbine wheels exhibited no evidence of overheating.

MEDICAL AND PATHOLOGICAL INFORMATION

A postmortem examination of the pilot was conducted under the authority of the Alaska State Medical Examiner, 4500 South Boniface Parkway, Anchorage, Alaska, on April 21, 2008.

The examination revealed the cause of death for the pilot was attributed to multiple traumatic injuries resulting from a helicopter accident.

The FAA's Civil Aeromedical Institute (CAMI) conducted a toxicological examination on April 24, 2008, which was negative for any alcohol or drugs.

SEARCH AND RESCUE INFORMATION

The helicopter was equipped with a commercial satellite tracking system capable of being monitored by the operator. As previously noted, the operator's satellite system had received an OVERDUE notice at 0930 ADT/1230 CDT, at the operator's main facility in Lake Charles, Louisiana. However, no one was monitoring Alaska flights, and the operator's facility in Alaska was not equipped to receive an OVERDUE alert. Therefore, the search and rescue authorities were not notified at that time. The operator was notified about the helicopter not returning to pickup the technician about 1530, and according to the operator their computer map showed the helicopter near one of the destinations. After attempts to contact the helicopter failed, the operator contacted the FAA and reported the helicopter missing. The FAA issued an Alert Notice (ALNOT) at 1545 and the AFRCC was notified.

In addition to the commercial satellite tracking system the accident helicopter was equipped with a 121.5 MHZ Emergency Locator Transmitter (ELT) required by Federal Aviation Regulation. About 1121 the AFRCC received a first alert that a search and rescue satellite had received a transmission from a 121.5 MHZ ELT in the general vicinity of Chickaloon. They were unaware of any missing aircraft, and followed their standard protocols by initiating a preliminary telephone search at 1147. Local and federal agencies and airports were contacted for information pertaining to overdue and missing aircraft, and for possible false activations at area airports. The FAA was contacted for flight plans in the area. No pertinent information was received. At 1300 the AFRCC initiated actions to send aircraft to search for the ELT. At 1532 search aircraft arrived over the area, and were receiving ELT transmissions, but were turned back due to low ceilings, reduced visibility and snow showers. At 1652 search aircraft were again turned back by weather in the search area. At 1807 Alaska State troopers arrived in the area on the highway, but were unable to locate the helicopter. Air and ground searchers continued throughout the night in an attempt to reach the helicopter.

The following morning an Alaska State Trooper helicopter was able to reach the accident site about 0750. The State Trooper helicopter landed on an open ledge above the accident site. The helicopter's observer/EMT climbed down to the accident helicopter, and determined that all aboard were deceased. On the approach to the accident site, the Trooper pilot and observer saw a person moving in the bottom of the ravine below the accident site. The pilot and observer flew to the bottom of the ravine where they recovered the technician's stepson. The stepson was flown to the hospital in Palmer, Alaska. The IIC met the helicopter at the hospital, and returned to the accident site with the helicopter to examine the accident helicopter and site.

TESTS AND RESEARCH

Fuel Flow Control Lever

The fuel flow control lever has three positions along the lever's track. In the aft portion of the lever track there is an elongated detent which serves as the stop (off) and start position. About one inch from the full forward position there is a second detent which serves as the flight position. The emergency position is forward of the flight position detent. Both detents are on the left (passenger) side of the lever track. The lever can be removed from the flight position detent, and pushed forward the remaining inch of travel into the emergency fuel control area. According to the helicopter Aircraft Flight Manual (AFM), in the event of a fuel governor failure associated with a low rpm condition, placing the lever in the forward emergency range bypasses the fuel governor, and allows the pilot to manually add fuel as necessary. The throw of the lever from the flight position to full forward is three-eighths of an inch to the right, and one inch forward. The lever is attached to a piece of spring steel, which allows it to move left-to-right, and is easily operated with fingertip control.

According to Eurocopter USA's test pilot, the inadvertent placing of the fuel flow control lever in the full forward (emergency) position in cruise flight unbeknown to the pilot would cause an engine over speed within seconds, and potentially result in shedding of the free turbine blades.

Two large helicopter operators, including ERA, and the helicopter's manufacturer, were queried about incidents of passengers interfering with the helicopter's floor-mounted engine controls, specifically the fuel flow control lever. Both operators said they had anecdotal information about passengers placing items, i.e. purses, camera bags, etc on the fuel flow control lever, as well as snagging bag straps on the fuel and other control levers. There was also anecdotal information about a front seat passenger stepping on the fuel control lever while turning to look at passengers in the rear seats. According to these operators, these events happened on the ground, were taken care of before any damage was done, and therefore were not reportable events. The manufacturer said they were not aware of any incidents relating to passengers inadvertently moving the engine controls.

A review of the manufacturer's technical data for the AS-350-B2 for 2004, 2005, and 2006 show that a guard for the floor mounted control quadrant was "being studied" and according to the manufacturer's technical data for the AS-350-B2 in 2007 a guard for the floor mounted control quadrant was available "On request." The majority of tour operators using the Eurocopter AS-350-B2 helicopter use an FAA Supplemental Type Certificated (STC) (SR00430NY), two-person seat on the front left side of the helicopter. The approved installation requires the installation of a guard on the left side of the floor mounted engine controls, to prevent the inadvertent manipulation of the engine controls by passengers.

In 1994 (ref. Transportation Safety Board report A94W0037) a Canadian registered Eurocopter AS-350-B helicopter crashed after a passenger inadvertently moved the floor mounted fuel flow control lever to the closed position while trying to adjust a knapsack placed under his right knee.

In its findings the TSB of Canada sited that:

1. The fuel flow control lever was accidentally moved out of the "flight "position.
2. The fuel flow lever is not guarded or protected against inadvertent movement.
3. The fuel flow lever can be moved out of the "flight" position easily.
4. The combination of low altitude, low rotor rpm, high ground speed at impact, and uneven terrain resulted in an autorotation with substantial damage to the helicopter.
5. The pilot was certified, trained, and qualified for the flight in accordance with existing regulations.
6. The aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures.

The TSB found the cause of the accident was the floor mounted fuel flow control lever was inadvertently moved to the closed position, resulting in fuel starvation to the engine, a total loss of engine power, and low rotor rpm.

On September 22, 1994 the TSB forwarded an Aviation Safety Information letter to Transport Canada (TC) regarding the possibility of inadvertent manipulation of the fuel flow lever on the AS-350-B helicopter. According to the TSB report, Transport Canada and the industry are investigating the feasibility of installing a control quadrant guard to reduce the likelihood of inadvertent fuel control lever movement.

In response to an inquiry by the IIC, the helicopter's manufacturer reported that in the 1994 accident in Canada, and in an additional accident in 1998 in France, the left front seat had been removed. In 1994 the seat had been replaced with a patient litter, and in the 1998 accident the passengers (photographers) were seated on and fastened directly to the floor. In both accidents the fuel flow control lever was moved to the aft position (off) by the passengers, resulting in the fuel starvation of the engine, as opposed to being moved forward into the emergency position. The manufacturer studied and proposed a guard to be installed with the Emergency Medical Service (EMS) litter installation, but said that due to lack of interest by the operators, the guard was withdrawn as an option in 2007.

In November 2006, an AS-350-BA helicopter experienced a ground resonance occurrence~~received substantial damage~~ (see NTSB report MIA07TA017) after~~when~~ the pilot inadvertently advanced the fuel flow control lever into the emergency range during engine start~~while preparing to takeoff~~. The NTSB determined that the probable cause of this accident was “the pilot’s failure to maintain aircraft control during engine start. Contributing to the accident was the pilot’s improper advancement of the fuel control lever.”~~According to the report~~

~~the engine rpm increased so rapidly that each time the pilot released the collective control to retard the fuel flow control lever the helicopter exceeded maximum torque and lifted off, and the pilot had to force the helicopter back to the ground. The pilot was eventually able to retard the fuel flow, but not before a series of bounces resulted in structural damage to the helicopter.~~

The AS-350-B2 helicopter has clear acrylic windows in the lower portion of the nose. These windows located on both the left and right side of the helicopter just ahead of the pilot and front seat passenger's feet, help the pilot see the ground during landing. These windows are commonly referred to as the left and right chin bubbles. The chin bubbles are 20 inches wide, about 16 inches high, and curved to conform to the nose of the helicopter. The bubbles are held in place by rubber grommets.

During the initial on site examination of the accident helicopter, a shoulder pack, identified as belonging to the left front seat passenger (stepson of one of the technicians), measuring about one foot square and three inches deep, with a single shoulder strap, was found about two feet in front of the helicopter, along with the left chin bubble which had popped loose from its mounting in front of the front seat passenger. The pack was between the chin bubble and the opening in the nose of the helicopter where the chin bubble had been.

No other bags were found in the cabin of the helicopter. Numerous personal bags and equipment were found secured in the aft storage compartments of the helicopter.

ADDITIONAL INFORMATION

As noted, the juvenile passenger was sitting in the left front seat. He received serious head trauma, and does not recall many specific details of the accident. During a telephone interview with the IIC, while her son was in the hospital, the survivor's mother questioned the IIC as to whether the pilot might have been letting her son fly the helicopter during the accident flight. She said her son kept telling her he was responsible for the accident. The dual flight controls on the left side of the helicopter had been removed, negating the possibility of the pilot letting the passenger manipulate the flight controls; however, the helicopter's floor-mounted engine fuel flow control lever was located between the front seats near his feet.

During an interview with the juvenile, he told the IIC that he remembered waiting for the helicopter, and when his stepfather heard the helicopter coming he told him to stay back until the helicopter landed. He said after loading equipment into the rear of the helicopter, the pilot placed him in the left front seat, and explained a little about the helicopter. He said after the helicopter picked up to a hover he remembered thinking how cool it was, and then the pilot performed flat left and right turns before departing in a shallow banked right turn. The passenger said the next thing he remembered was feeling like he was falling, and that the pilot told everyone to "hold on because they were going to crash." He did not specifically remember where he had placed the pack. He also did not relate why he told his mother he felt responsible for the accident. The

passenger said after the crash he remembered being told to get out of the helicopter because "they" thought there might be a fire.

Flight Simulations

During the investigation the IIC attempted to run flight simulations based on data received from the accident helicopter's satellite tracking, witness interviews, and known helicopter operation and performance. In order to simulate the accident flight, a flight training device (FTD) would have to be capable of accurately replicating the helicopter's fuel flow control lever input and the associated engine response. The operator (ERA) offered an AS-350-B2 FTD, designed and built by Frasca International, Urbana, Illinois, which had been recently installed at ERA's training facility at Lake Charles, Louisiana. The FTD was certified to level 6 under FAR Part 60. The offer to use the FTD was withdrawn prior to doing the simulations. Subsequently the IIC was told by the ERA party representative, that Frasca was unable to program the FTD to respond correctly to fuel flow control lever inputs in the emergency mode. The IIC contacted Flight Safety International in Tucson, Arizona, about conducting the simulations. On August 21, 2009, Flight Safety had announced the installation and certification to level 7, under CFR Part 60, of their new Frasca International designed, AS-350-B2 FTD. The IIC asked that Flight Safety check the engine response to the fuel flow control lever movement on their FTD. After the check the IIC was told that there was a problem, and the FTD was undergoing repairs. Subsequent discussions with Flight Safety determined that the FTD would shutdown prior to reaching the turbine blade shedding speed, and the FTD is not presently programmed to accurately replicate the full range of engine rpm associated with the fuel flow lever in the emergency mode.

Neither the AS-350-B2 Flight Manual nor the Eurocopter Pilot Flight Training Manual contain information regarding an engine over speed resulting from the fuel flow lever being inadvertently placed in the forward emergency position. The only reference to the fuel flow lever being placed in the forward emergency position is in the emergency section of the flight manual under Governor Failure. The reference is in relation to an engine governor failure resulting in a loss of engine rpm. In this procedure the manual states in part: "Establish autorotation indicated airspeed 65 knots, then advance the fuel flow control into the emergency sector. The NG should rise."

In the event of a governor failure resulting in an excessive fuel flow (similar to what the pilot would see if the fuel flow lever were inadvertently placed in the emergency sector), the NG would increase. In this event the Governor Failure section says in part: "Do not reduce collective. Reduce the fuel flow until the rotor speed corresponds to a position of the pointer in the center of the green area."

According to an ERA's Vice President of Operations in Anchorage, due to the AS-350-B2 engine fuel control unit design, the governor cannot be taken out of the system to simulate an

engine over speed condition. For that reason, engine over speed training is limited to a discussion of symptoms and actions to be taken by the pilot referenced in the helicopter's flight manual.

Helicopter Height Velocity Curve

The Height-Velocity diagram or H/V curve is a graph charting the safe/unsafe flight profiles relevant to a specific helicopter. In the H/V diagram the shaded areas should be avoided, as the pilot may be unable to complete an autorotation landing without damage. The H/V curve will usually contain a take-off profile, where the diagram can be traversed from 0 height and 0 speed to cruise, without entering the shaded areas or with minimum exposure to shaded areas.

A copy of the H/V curve for the accident helicopter taken from the helicopter's Flight Manual is contained in the docket for this report.

The satellite tracking data indicated that the accident helicopter picked up on a heading of 067 degrees, and departed on a heading of 142 degrees, but the altitude data showed that the helicopter climbed only about 10 feet. Data from earlier flights that day showed the helicopter climbed significantly after departure. The terrain descended about 424 feet in the three-quarters of a mile from the departure point to the accident location. The terrain was rough and uneven with trees and high brush covered with snow. The helicopter's Height Velocity Curve (HV) depicted in the flight manual notes the avoidance zone as 500 feet agl with 0 knots airspeed, with the avoidance zone decreasing in altitude, and increasing in airspeed, until the helicopter reaches 100 feet agl and 50 knots airspeed. According to the manufacturer, the helicopter should be able to safely autorotate and land, if a suitable landing area is available, when operated outside the avoidance zone.

As it is unknown what the helicopter’s actual airspeed and altitude above the ground were prior to the accident event, it was not possible to calculate if the helicopter was being operated within or out of the H/V avoidance zone.